

SatNOGS 2017 Update

Satellite Networked Open Ground Stations

Corey Shields - KB9JHU

“Ground Station Shepherd”



Goal of SatNOGS

Today, many satellite operators and researchers rely on amateur ground station operators to provide data from their satellites.

..with the increase in cubesat and nanosat launches this model does not scale.



Quad pack credit: ISIS Space

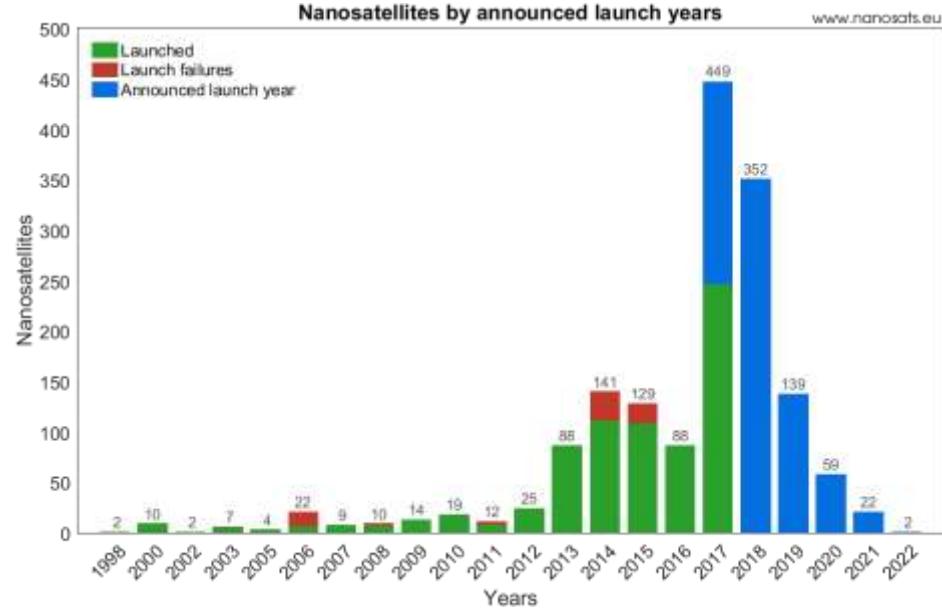


Sherpa Launcher, credit Spaceflight Inc.

Goal of SatNOGS

Automate the process!!!

- Automate the satellite tracking
- Automate the RF demodulation and tuning
- Automate the doppler shift changes
- Automate the data decoding
- Automate the uploading of artifacts



Hardware

Bring Your Own

- Any rotator supported by hamlib/rotctld

Build Your Own

- We offer an open hardware, 3D printable rotator design
- ~\$300 fully assembled



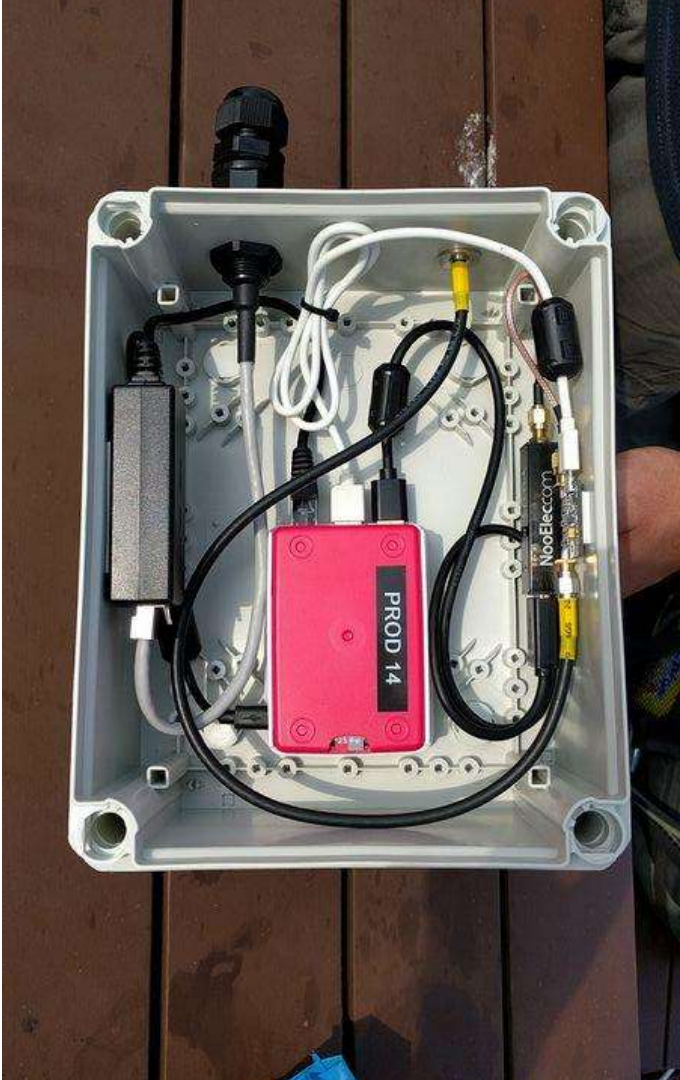
Hardware

Reference platform: Raspberry Pi3 + rtl-sdr

Works with any SDR supported by gr-osmosdr
(high sample rates not working well on the RasPi)

Client runs on any Linux platform with
Python 2.7 and Gnuradio 3.7.10

LNA highly recommended, LNA4ALL or others



db.satnogs.org

Crowd-sourced satellite database

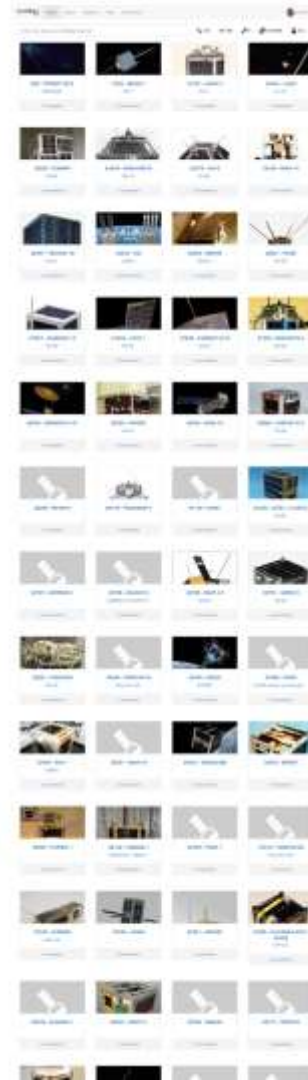
- Status, frequencies, keps

Repository for collected telemetry data

- API that works with 3rd party apps
 - DK3WN TLM Forwarder
 - Gr-satellites sides forwarder
 - Gpredict (sat data)

- Download collected data

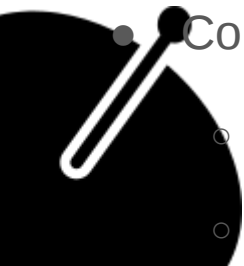
To date: over 8 million frames from 80 stations



network.satnogs.org

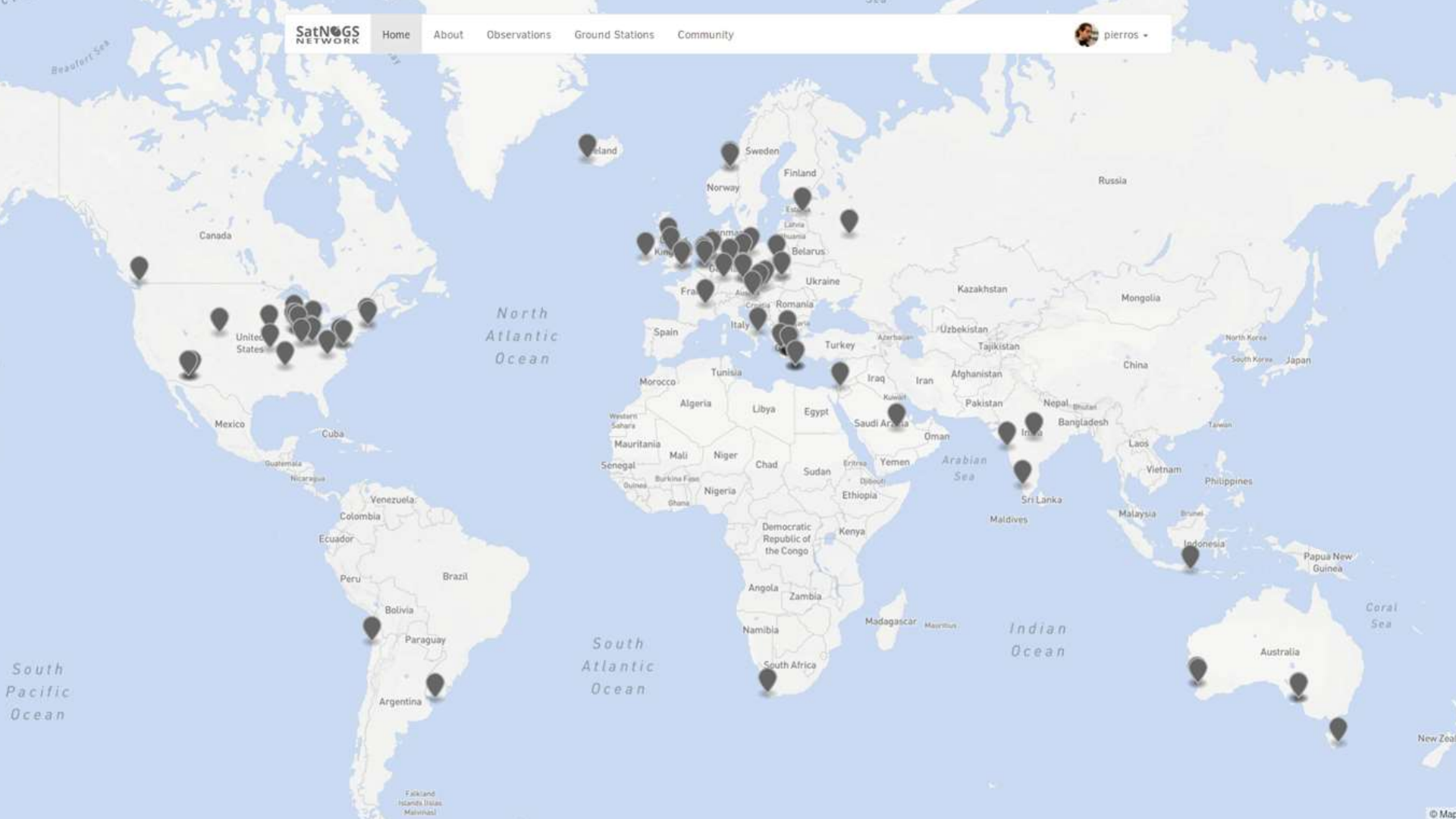
“Network” is the central scheduling system for SatNOGS

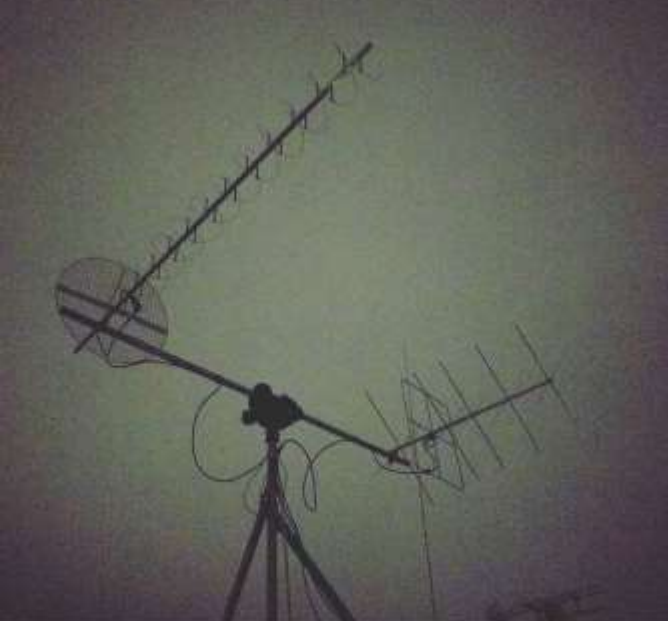
- Schedule observations, managing available/capable ground stations
 - Example: “Collect all TLM data for UPSat from 0800-1400”
 - All available ground stations that UPSat passes during that period will be scheduled
 - Single-observation scheduling is also available (“SO-50 is passing KB9JHU from 0813-0826, collect the FM Voice signal”)



- Collects and displays results from observations when finished

- Waterfalls
- Demodulated audio





SatNOGS Client

- Checks in with the network regularly
- When a job is scheduled,
 - a. Commands the rotator
 - b. Starts a gnuradio script to collect RF
 - c. Adjusts frequency for doppler correction
 - d. Generates a waterfall, audio, etc.
 - e. Uploads the results
- Comes in a ready-to-flash RPi3 image

The screenshot displays the SatNOGS Client web interface. At the top, there are tabs for 'Status', 'Control', and 'Configuration'. A green 'Follow Me!' button is visible on the right. Below the tabs, the 'Ground station' section is active, showing coordinates (30.2, -95.3), altitude (200.0), azimuth, elevation, and frequency. A 'Scheduled observations' dropdown menu is present. Below this, a table lists scheduled observations with columns for ID, Satellite, Frequency, Encoding, and Timeframe. The table contains three rows of data. At the bottom, a 'Terminal' window shows a log of system messages, including attempts to get observation jobs from the network, pod data starting, status view initialization, and received mode changes.

ID	Satellite	Frequency	Encoding	Timeframe
24344	NCIAX 10	137103000	APF	2017-10-26T21:52:25Z-2017-10-26T22:06:54Z
24345	GOMX 1	437262500	CW	2017-10-26T22:19:25Z-2017-10-26T22:29:52Z
24346	XW-20	145835300	QAM50K85	2017-10-26T22:46:45Z-2017-10-26T22:58:39Z

```
17:00:00 [INFO] Trying to GET observation jobs from the network
17:00:00 [INFO] Pod data started
17:00:00 [INFO] Status view initiated
17:00:00 [INFO] Received mode change: ("custom_cmf", ("mode", "network"))
17:00:00 [INFO] Get jobs started
17:00:00 [INFO] URL: https://network.satnogs.org/api/jobs/
17:00:00 [INFO] Params: {"ground_station": 3}
17:00:00 [INFO] Headers: {"Authorization": "Token c0c0f0b040a40cfab3172c4d7afa0443de4526a1"}
17:00:00 [INFO] Trying to GET observation jobs from the network
17:00:00 [INFO] Pod data started
```

Project Progress

Milestones in the past year:

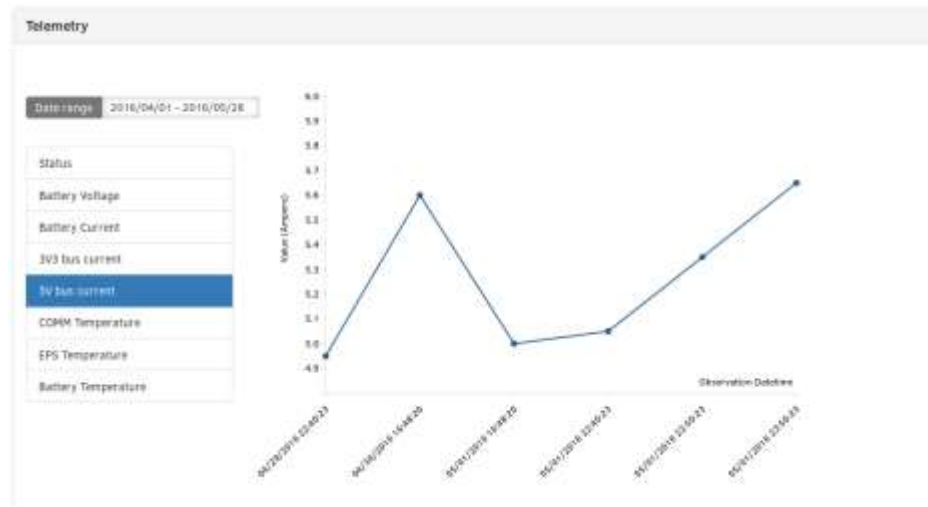
- (Network) Automated decoding of APT, FSK9k6 frames
- (DB) SiDS frame support, import of data from PE0SAT db
- (DB) Support for DK3WN tlm forwarder
- (Client) Raspberry Pi SD image, “sudo satnogs-setup” to config/install/update



Project Roadmap

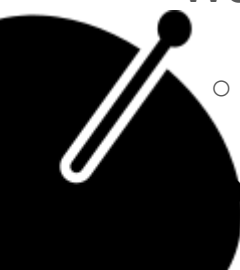
Coming soon:

- (Network) Upload of captured frames to db
- (Network) Automated observation scheduling
- (Client) Decoding more modes: CW, AFSK1k2, BPSK
- (DB) Telemetry dashboards!



How to Get Involved

- We need ground stations!
 - Grab a raspberry pi 3 and an rtl-sdr
 - Run satnogs-client when you are not using your ground station
- We need programmers!
 - python, web, js, gnuradio
- We need satellite enthusiasts!
 - Help us maintain the DB, schedule and vet observations in Network



cs: **wiki.satnogs.org**

Demos!

<https://network.satnogs.org/observations/21945/> (APT, NOAA 19)

<https://network.satnogs.org/observations/22682/> (CW, CAS-4B)

<https://network.satnogs.org/observations/22666/> (FSK9k6, FALCONSAT-3)

<https://network.satnogs.org/observations/21733/> (FM, SO-50)

<https://network.satnogs.org/observations/24089/> (ARISS)

<https://db.satnogs.org/>

